植物研究雑誌
J. Jpn. Bot.
73: 185–198 (1998)

Differentiation of *Adonis* L. in Japan V. Floral Characters, Aggregate Fruits and Seeds

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(Received on January 29, 1998)

Morphological characters of petals and sepals, aggregate fruits and seeds were examined in diploid and tetraploid *Adonis amurensis* Regel & Radde in Japan. As the flower developed, petal shape varied in the following order; *ellipticus* → *obovatus* → *obtrullatus*, including intermediates among them. However, all types were not always observed in every population. On the basis of the variation mode of the L/W values of petals the diploid and the tetraploid populations were grouped into three, viz. the first group having a wide range of L/W values, the second one with a narrow range and the third one with an intermediate one in L/W values. In sepals the shape varied as follows; *trullatus* → *rhombicus* → *obtrullatus*, including intermediates among them. However, all types were not always observed in every diploid and tetraploid population. The L/W values of sepals during floral development were rather constant in both diploid and tetraploid populations. The tetraploid plants had prolate spheroidal, subprolate and/or prolate aggregate fruits with lengths of 14.5–21.0 mm at polar axis and the diploid plants had suboblate and/or oblate spheroidal ones with lengths of 8.0–11.0 mm. The number of achenes/aggregate fruit was quite different among diploid (24–53) and tetraploid (55–99) plants. The frequency of sterile achenes/aggregate fruit was higher in diploid (10–52%) than in tetraploid (2–30%) plants. Seed lengths tended to increase as the chromosome numbers varied from diploid to tetraploid. The pattern of seed coats was more distinct in diploids than in tetraploids. The seed coart color was brown in diploids and brownish-black in tetraploids. (Continued from Acta Phytotax. Geobot. **46**(1): 29–46, 1995)

Gorovoy and Gurzenkov (1969) were the first to mention significant relationships between the difference of chromosome numbers and (1) the ratio of sepal length to petal length and (2) the number of flowers per stem in the revision of continental Asian and Japanese *Adonis*.

Nishikawa and Ito (1978, 1979, 1985) also discussed relationships between the variation of chromosome numbers and various morphological characters in detail. Later, Nishikawa (1989) concluded that three species, viz., *Adonis amurensis* Regel & Radde, *A. ramosa* Franch. and *A. multiflora* Nishikawa & Ko. Ito, were recognized in Japanese *Adonis* that had been treated taxonomically as being included in a single species, *Adonis amurensis* Regel & Radde.

In the previous paper I reported that the ratio of sepal length to petal length, the number of sepals and the filament length were the characters that had strong correlations to euploid changes of chromosome number, and confirmed the results obtained by Nishikawa and Ito (1978, 1979). In addition, I indicated that the variation pattern of the number of

Table 1. List of localities of populations, abbreviations of each population, numbers of materials examined and voucher specimens of *Adonis amurensis*

Locality*, abbreviation of each population and voucher		Materials examined** S & P	Ag	Sd
<Diploid Populations>				
Mukaikubo, Iwate-machi 岩手町，向久保 Suda MK5884 (IUM)	MK5884		50†	100
Kamimura, Nishine-chô 西根町，上村 Suda KM5884 (IUM)	KM5884		50†	100
Nagaisawa, Tamayama-mura 玉山村，永井沢 Suda NI52480 (IUM)	NI52480	7(19)	50	100
Sanmaiishi, Tamayama-mura 玉山村，三枚石 Suda SI52480 (IUM)	SI52480		37	
Ôfutago, Tamayama-mura 玉山村，大二子 Suda FG5380 (IUM)	FG5380	7(15)	50	100
Takakubo, Tamayama-mura 玉山村，高久保 Suda TK33073 (IUM)	TK33073		50	
Shirasawa, Tamayama-mura 玉山村，白沢 Suda SS151577 (IUM)	SS151577			100
Nakakugi-no-taira, Tamayama-mura 玉山村，中釘ノ平 Suda NK241577 (IUM)	NK241577		28†	100
<Populations having Triploid Plants>				
Shirasawa, Tamayama-mura 玉山村，白沢	SS152278		16***	
Toriyasawa, Tamayama-mura 玉山村，鳥谷沢	TY52277		2	
Akasaka, Tamayama-mura 玉山村，赤坂	AS51584		15	
Nakakugi-no-taira, Tamayama-mura 玉山村，中釘ノ平	NK141577		21	
Makibori, Tamayama-mura 玉山村，巻堀	MH43086		5	
Tobita, Tamayama-mura 玉山村，飛田	TT5386		9	
cv. Fukujukai 福寿海（栽培）	CVFJK		13	
<Tetraploid Populations>				
Ômori, Iwate-machi 岩手町，大森 Suda OM52584 (IUM)	OM52584		50†	100
Matsubara, Iwate-machi 岩手町，松原 Suda MB42780 (IUM)	MB42780		50	
Ashidauchi, Iwate-machi 岩手町，芦田内 Suda AU42384 (IUM)	AU42384		50†	100
Hirukubo, Tamayama-mura 玉山村，昼久保 Suda HK52481 (IUM)	HK52481		50†	100
Yabukawa, Tamayama-mura 玉山村，藪川 Suda KD42280 (IUM)	KD42280	7(20)	50	100
Jônaidate, Tamayama-mura 玉山村，城内舘 Suda JD51576 (IUM)	JD51576			100
Hinoto, Tamayama-mura 玉山村，日ノ戸 Suda HT41380 (IUM)	HT41380	5(18)	50	100
Furuyashiki, Tamayama-mura 玉山村，古屋敷 Suda FH42384 (IUM)	FH42384		50†	100
Takakô, Tamayama-mura 玉山村，鷹高 Suda TT33073 (IUM)	TT33073		23	
Tashiro, Kawai-mura 川井村，田代 Suda TS4973 (IUM)	TS4973	6(16)		
Kudashizawa, Hanamaki-city 花巻市，下シ沢 Suda MD42274 (IUM)	MD42274	6(15)		

flowers per stem in both diploid and tetraploid plants was not so simple as mentioned previously (Suda 1995).

In the present study further questions on floral morphology are addressed. How do petals and sepals vary the size and the shape in the process of floral development in diploid and tetraploid plants? How does the size and the shape of aggregate fruits and the number of achenes per aggregate fruit differ among diploid and tetraploid plants? Do morphological differences exist among the seeds of diploid and tetraploid plants?

Materials and Methods

Materials were collected from the following localities in Iwate Prefecture, northeastern Honshu of Japan (Table 1).

For the study of morphological variation of sepals and petals, flowers from two diploid populations and four tetraploid populations were collected by the following three procedures: collecting (1) all flowers on a single stem (three to seven flowers in diploids and one to four flowers in tetraploids), (2) all flowers in a single individual (ten to eighteen flowers, depending on the size of each individual), (3) twelve to twenty flowers at various developmental stages from different individuals that were selected through random sampling in a given population.

As the flower opening of *Adonis* proceeds from the top flower toward the base of a stem (Suda 1995), examination of the size and the shape of perianth segments of all flowers on a single stem according to the order of flower opening is considered in order to illustrate the developmental variation in a single flower.

The length of petals can be used as an indicator to determine the degree of floral development because the petals elongate in accordance with the floral development. Among plants belonging to the same population, variation patterns of the shapes in perianth segments are similar to each other. Therefore, flowers collected not only from a single individual but also from individuals belonging to the same population can be classified into three to four groups of different developmental stages by using the petal length as an indicator.

Based on the examination of shapes, lengths, and mean L/W values of perianth segments in each group, it is possible to illustrate the pattern of developmental variation in sepals and petals within a population (Figs. 1–4).

As the floral leaves develop centripetally in *Adonis*, sepals and petals for the study were obtained from the outermost portion, where fully developed ones exist. Measurements were made of five sepals and petals for each flower and mean L/W values were calculated along with the identification of shapes by using the terminology found in the Chart of simple symmetrical plane Shapes (Systematics Association Committee for descriptive Biological Terminology 1962).

For the study of the number of achenes and the frequency of sterile ones per aggregate fruit, 23–50 aggregate fruits, that grew at the apex of a stem, of different plants, from seven diploid and eight tetraploid populations were collected by random sampling (Table 1). The sampling was made just before the mature

Explanation of Table 1.

* All localities are in Iwate Prefecture.

** S & P: number of individuals and flowers (in parentheses) for the examination of the shape and the size of petals and sepals. Ag: number of aggregate fruits from different individuals. Sd: number of seeds collected by random sampling.

*** Number of pistiles per gynoecium was counted in case of triploid plants.

† Aggregate fruit size was measured before the total number of achenes per aggregate fruit was counted.

achenes were detached. The first week of May and the beginning of June were appropriate for collecting mature aggregate fruits in tetraploid and diploid populations, respectively. They were fixed with FAA solution in the field and stored in a deep freezer at –20°C.

A total number of achenes and the frequency of sterile ones per aggregate fruit were examined for the plants in diploid and tetraploid populations (Figs. 5, 6). As triploids did not develop achenes and aggregate fruits, the number of pistils per gynoecium was examined for sixteen triploid plants (Table 2).

Before detaching achenes from aggregate fruits, the polar length and the equatorial breadth of aggregate fruits were measured by using vernier calipers for 28–50 aggregate fruits collected from the plants of three diploid and four tetraploid populations by random sampling (Figs. 7, 8).

To examine the morphological features of seeds, mature aggregate fruits were collected by the same procedure at the above mentioned season from plants of six diploid and seven tetraploid populations. Mature achenes were detached and the carpels were removed by washing. After drying them thoroughly, a hundred seeds were selected by random sampling to measure the length by using vernier calipers (Fig. 9). The feature of seed coats in diploid and tetraploid plants was examined at the same time (Fig. 10).

Results

(1) *Variation of Perianth Segments during the Development*

The variation pattern of petal and sepal shapes obtained from two diploid and four tetraploid populations are shown in Figs. 1–4.

The petal shape varied as the flower developed in the following order; 2–4 *ellipticus* → 46–48 *obovatus* → 64–65 *obtrullatus*, including the intermediate shapes among them. However, all kinds of shapes were not always observed in every population (Fig. 1). In diploid populations one (NI52480) had four kinds of variations, (1) close to 3–4 *ellipticus*, (2) 47–48 *obovatus*, (3) intermediate between 46–47 *obovatus* and 64–65 *obtrullatus* and (4) 64–65 *obtrullatus*, but the other (FG5380) had three, (1) 47–48 *obovatus*, (2) intermediate between 47–48 *obovatus* and 65–66 *obtrullatus* and (3) 64–65 *obtrullatus*. In most tetraploid populations the shapes ranged only from 2–4 *ellipticus* to 46–47 *obovatus*, including one or two intermediates (Fig. 1).

As shown in the silhouettes of Fig. 1, the

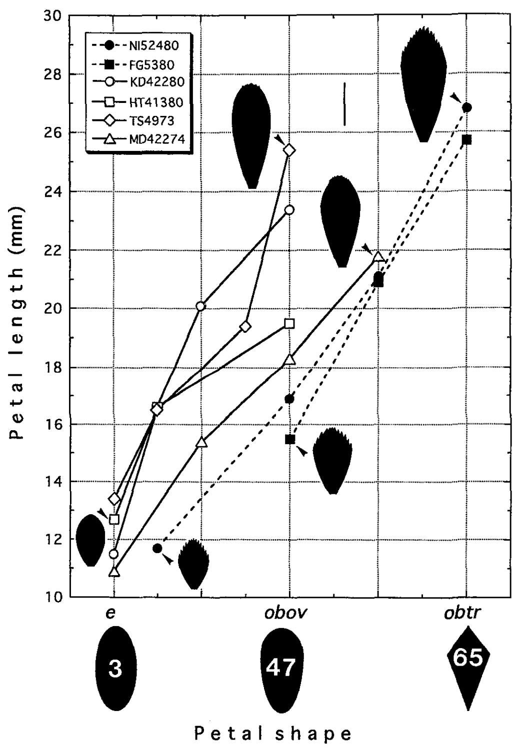


Fig. 1. Development of petal lengths (mm) and petal shapes of diploid and tetraploid plants of *Adonis amurensis*. Inserted silhouettes are the schematic drawings of petals at the points arrowed. Inserted numbers in silhouettes are the numbers given in the original Chart of simple symmetrical plane Shapes. *e*, *obov*, and *obtr* are abbreviations for *ellipticus*, *obovatus*, and *obtrullatus*, respectively. A bar inserted is 10 mm provided for the silhouettes.

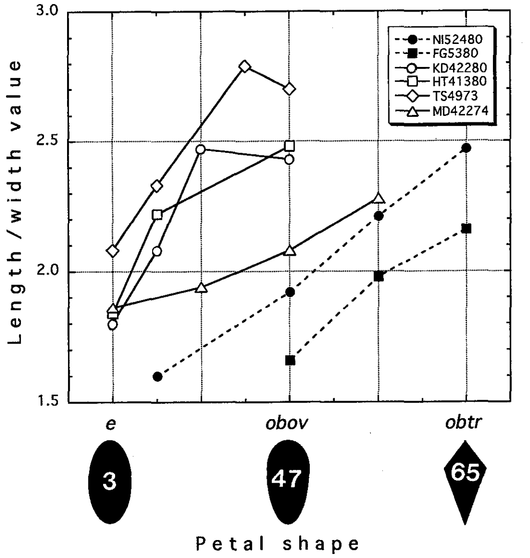


Fig. 2. Relationship between mean L/W value of petals and petal shapes of diploid and tetraploid plants of *Adonis amurensis.* Inserted numbers in silhouettes are the numbers given in the original Chart of simple symmetrical plain Shapes. *e*, *obov*, and *obtr* are abbreviations for *ellipticus*, *obovatus*, and *obtrullatus*, respectively.

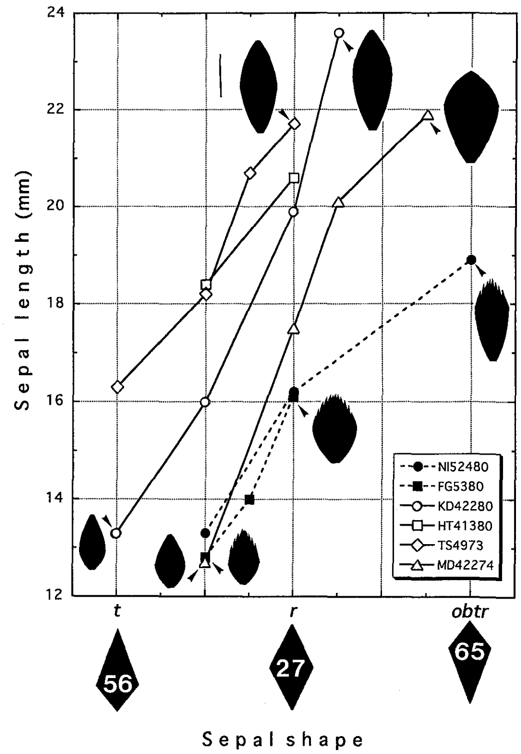


Fig. 3. Development of sepal lengths (mm) and sepal shapes of diploid and tetraploid plants of *Adonis amurensis.* Inserted silhouettes are the schematic drawings of sepals at the points arrowed. Inserted numbers in silhouettes are the numbers given in the original Chart of simple symmetrical plain Shapes, *t*, *r*, and *obtr* are abbreviations for *trullatus*, *rhombicus*, and *obtrullatus*, respectively. A bar inserted is 10 mm provided for the silhouettes.

actual shapes of petals were rounded off the edges with slightly incised apices. The incision at apices was distinct in diploids.

The L/W values of petals from juvenile flowers just after the opening of perianth segments and from ones at the peak of blooming differed considerably in diploid NI52480 population (0.87) and tetraploid TS4973 one (0.71) (Fig. 2). However, in diploid FG5380 population (0.50) and tetraploid MD42274 one (0.42) the L/W values of the petals varied little (Fig. 2). In the remaining two populations, tetraploid KD42280 (0.63) and HT41380 (0.64), the range of variation of the L/W values were intermediate between the above two groups (Fig. 2).

In sepals the shape varied during floral maturation in the following order; 55–56 *trullatus* → 26–28 *rhombicus* → 64–66 *obtrullatus*, including the intermediate shapes among them. However, all kinds of shapes were not always observed in every diploid and tetraploid population (Fig. 3). For example, in diploid populations the series of variation lacks the 55–56 *trullatus* one. In tetraploid populations it ranges from 55–56 *trullatus* to the shape close to 65–66 *obtrullatus*, together with the intermediate ones, but the 64–66 *obtrullatus* one was not encountered (Fig. 3).

As shown in the silhouettes of Fig. 3, the actual shapes of sepals were rounded off the edge with slightly incised apices. The incision at apices in diploids was distinct.

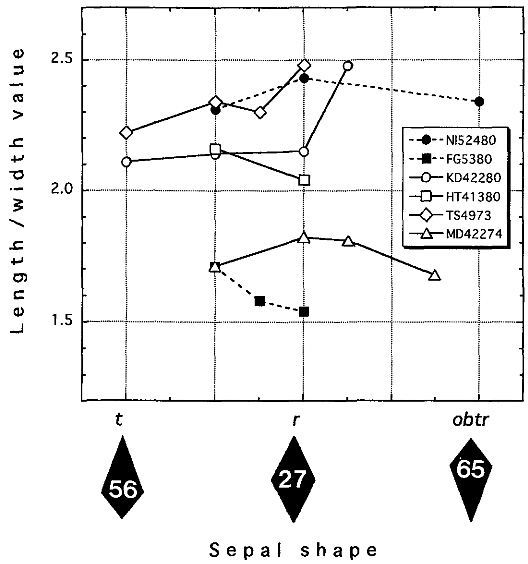


Fig. 4. Relationship between mean L/W value of sepals and sepal shapes of diploid and tetraploid plants of *Adonis amurensis*. Inserted numbers in silhouettes are the numbers given in the original Chart of simple symmetrical plain Shapes. *t*, *r*, and *obtr* are abbreviations for *trullatus*, *rhombicus*, and *obtrullatus*, respectively.

Comparing the L/W values of sepals from flowers at the peak of blooming with that of juvenile ones just after the perianth opening, there was only a little difference in both diploid and tetraploid populations (Fig. 4). The L/W values increased a little in one diploid (NI52480; 0.12) and two tetraploid populations (TS4973; 0.26, KD42280; 0.37), but in the other remaining ones the values decreased as the flowers developed (Fig. 4).

(2) *Aggregate Fruits and Achenes*

The tetraploid plants had prolate spheroidal, subprolate and prolate aggregate fruits (L/W values; 1.1–1.4) with lengths of 14.5–20.9 mm at polar axis and the diploid plants had suboblate and oblate spheroidal ones (L/W values; 0.85–1.0) with lengths of 8.0–11.0 mm.

The number of achenes and the frequency of sterile ones per aggregate fruit in diploid and tetraploid plants are shown in Figs. 5 and

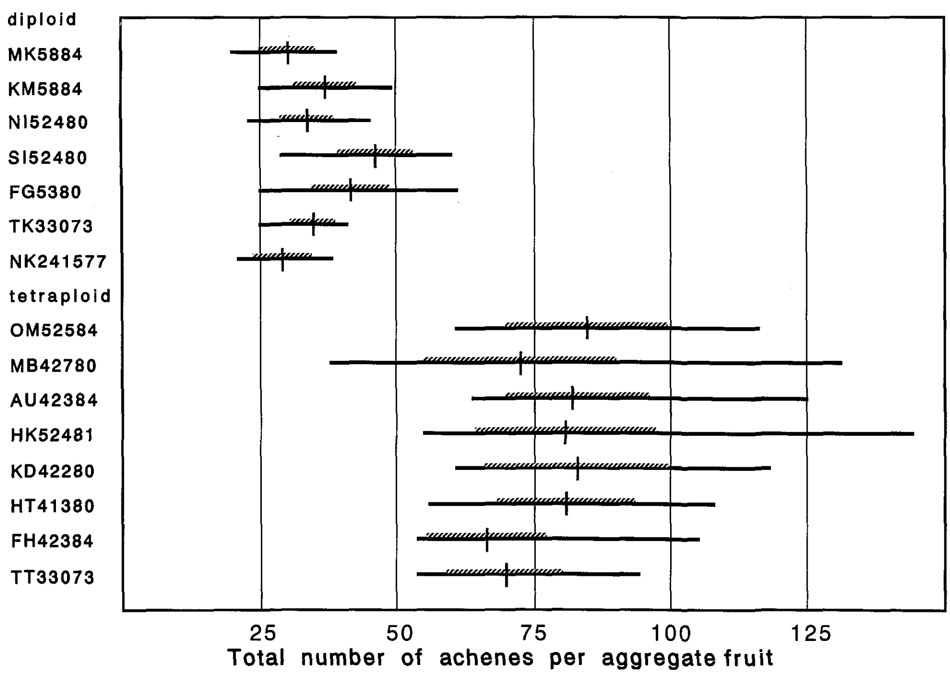


Fig. 5. Total number of achenes per aggregate fruit from diploid and tetraploid plants of *Adonis amurensis*. The mean (vertical line), range (horizontal line) and standard deviation (striped bar) are presented.

6. It can be observed in Fig. 5 that the number of achenes per aggregate fruit was quite different among diploid and tetraploid plants. Diploids had 24–53 achenes, while tetraploids had 55–99 ones on average (Fig. 5). Instead of achenes the pistils per gynoecium were counted in triploid plants (Table 2).

The frequency of sterile achenes per aggregate fruit was higher in diploid plants (10–52%) than in tetraploid ones (2–30%) (Fig. 6).

The range of aggregate fruit size in diploids and tetraploids scarcely overlapped one other (Figs. 7, 8).

As for the shape of aggregate fruits the polar length was shorter than the breadth in diploids and vice versa in tetraploids (Figs. 7, 8). This means that the tetraploid plants had large prolate spheroidal aggregate fruits with many achenes (55–99), while the diploid individuals had small spheroidal or oblate spheroidal ones with fewer (24–53) achenes.

(3) *Seed Size and Seed Coat Features*

The mean values of seed length were 3.1–4.3 mm in diploids, while in most tetraploids they were 4.1–4.9 mm (Fig. 9). However, tetraploids from population FH42284 yielded smaller seeds (3.6–4.1 mm). The length of seeds tended to increase as the chromosome numbers varied from diploid to tetraploid (Fig. 9). The pattern of seed coat was more distinct in diploids than in tetraploids (Fig. 10). The color of seed coats was brown in diploids and brownish-black in tetraploids.

Table 2. Number of pistils per gynoecium in triploid plants of *Adonis amurensis*

Individual number	Number of flowers examined	Number of pistils per flower (mean value)
SS152278-1	4	78.0
SS152278-2	9	66.2
SS152278-3	3	71.0
TY52277-4	2	96.0
AS51584-1	5	79.2
AS51584-2	5	73.0
AS51584-3	5	70.8
NK141577-1	8	94.9
NK141577-2	9	64.3
NK141577-3	4	53.0
MH43086-1	5	101.4
TT5386-1	9	75.8
CVFJK-1	2	49.0
CVFJK-2	5	57.4
CVFJK-3	2	59.5
CVFJK-4	4	55.3

Discussion

It was noticed in the field that the L/W values of petals influenced the impression of floral appearance. By comparing the L/W values of petals from juvenile flowers just after perianth opening with those from fully developed ones, I distinguished three groups in diploid and tetraploid populations. In the first group, in which diploid NI52480 and tetraploid TS4973 populations are included, the wide range of the L/W values (0.71–0.87) that varies parallel with the change of shapes gives the impression that the petals become slenderer as the flowers mature. In the second group, containing diploid FG5380 population and tetraploid MD42274 one, the small range of values (0.42–0.50) shows that the petals vary themselves in shape and length as the flowers develop, but the floral appearance remains unchanged from juvenile stages just after perianth opening to the fully developed ones at the peak of blooming. In the third group, to which tetraploid KD42280 and HT41380 populations belong, the intermediate range of L/W values (0.63–0.64) of petals indicates that the flowers at the peak of blooming were likely to have changed only slightly during the floral development.

The above observation was supported by the results I obtained from the comparison of photographs of flowers taken two to three times from the same spot with the same angle during the flowering period in experimental greenhouse (Figs. 11, 12). The floral appearance changed much in some plants (CN32673),

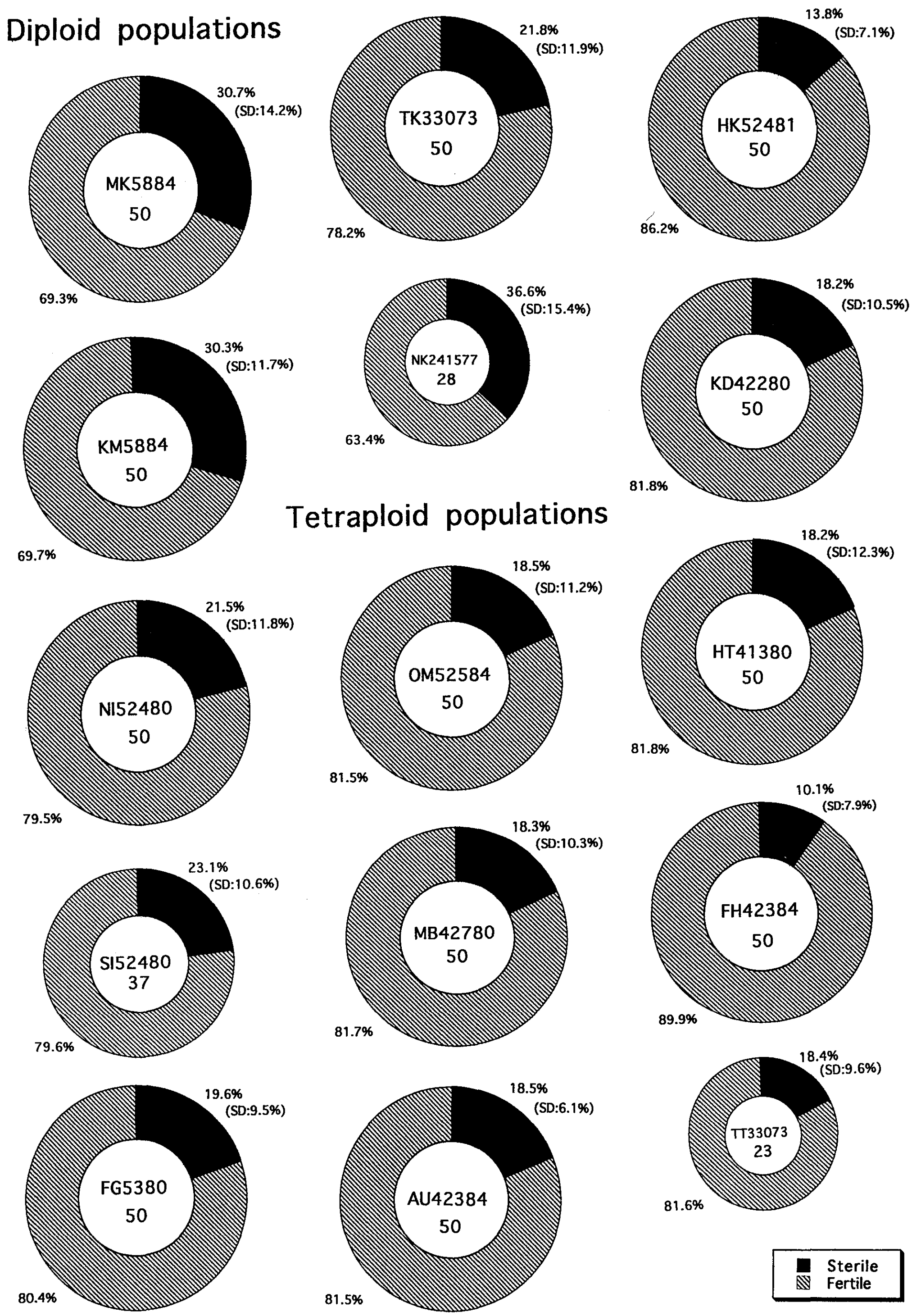


Fig. 6. Pie-charts showing frequencies of sterile and fertile achenes per aggregate fruit. Population number and number of plants examined are shown in the inner circle. Standard deviations of the frequency for sterile achenes are in parentheses. The size of each circle is in proportion to the number of plants examined.

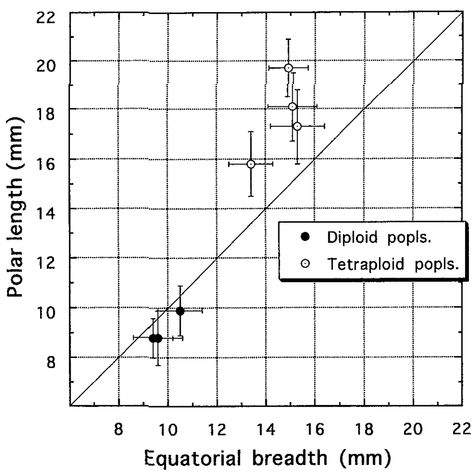


Fig. 7. A graph showing the relationship between diploid and tetraploid plants in the characters, polar length and breadth of aggregate fruit.

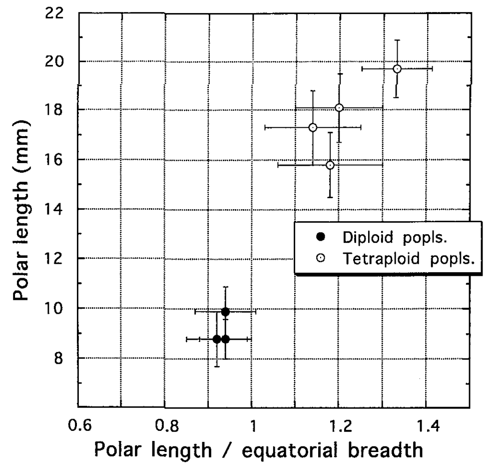


Fig. 8. A graph showing the relationship between diploid and tetraploid plants in the characters, ratio of breadth to polar length and polar length.

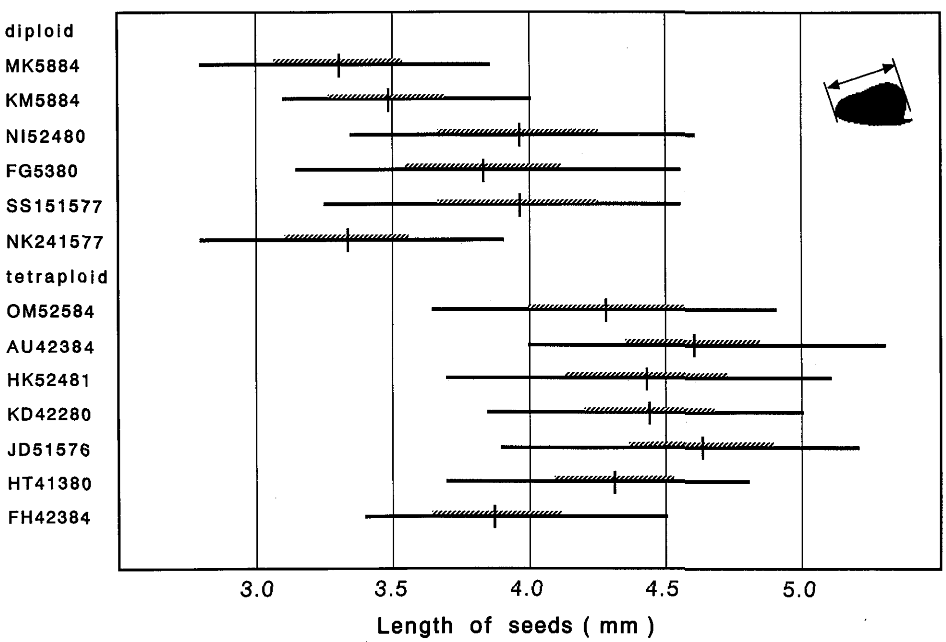


Fig. 9. The length of seeds from diploid and tetraploid plants of *Adonis amurensis*. The inserted silhouette shows a measured portion of the seed. The mean (vertical line), range (horizontal line) and standard deviation (striped bar) are presented.

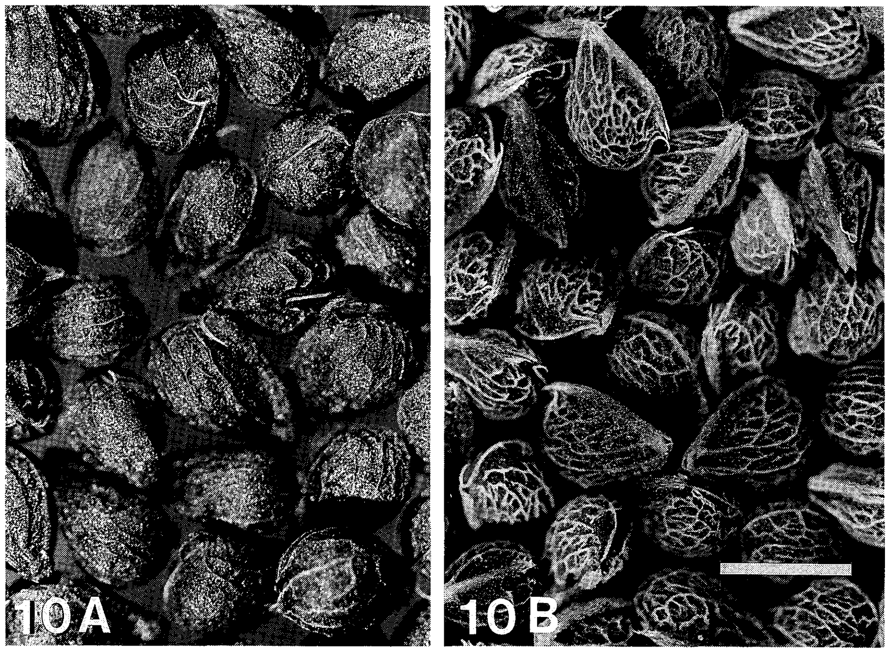


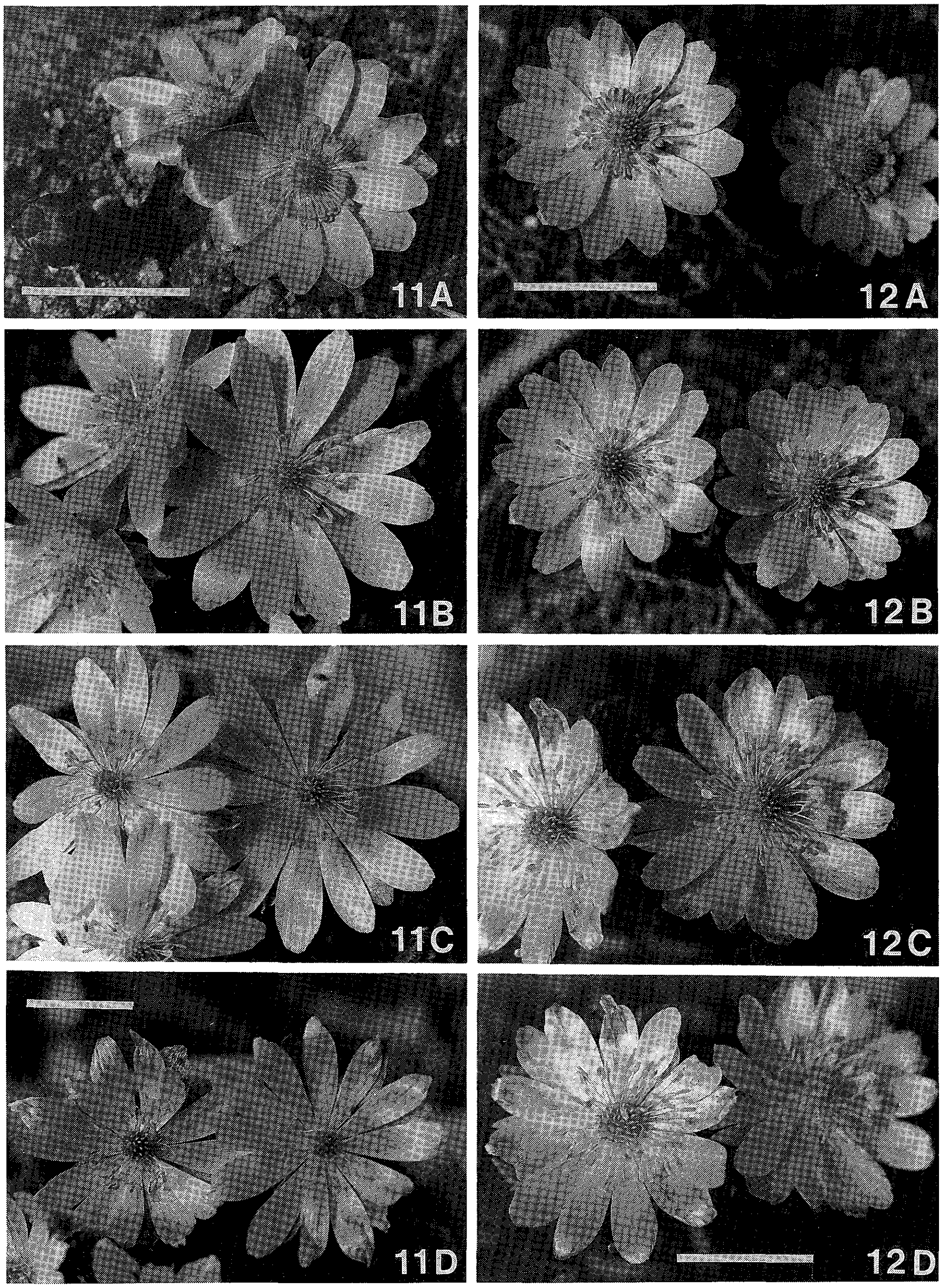
Fig. 10. Dried seeds from diploid (B) and tetraploid (A) plants of *Adonis amurensis*. The diploid has a distinct seed coat pattern (FG5380), while the seed coat pattern of the tetraploid is obscure (KD42280). A bar inserted is 3 mm.

while in others it changed little (NT4273). Further, my field observation that flowers at different developmental stages varied greatly in their appearance within the same individual and/or population would also support the above statements (Figs. 13–15).

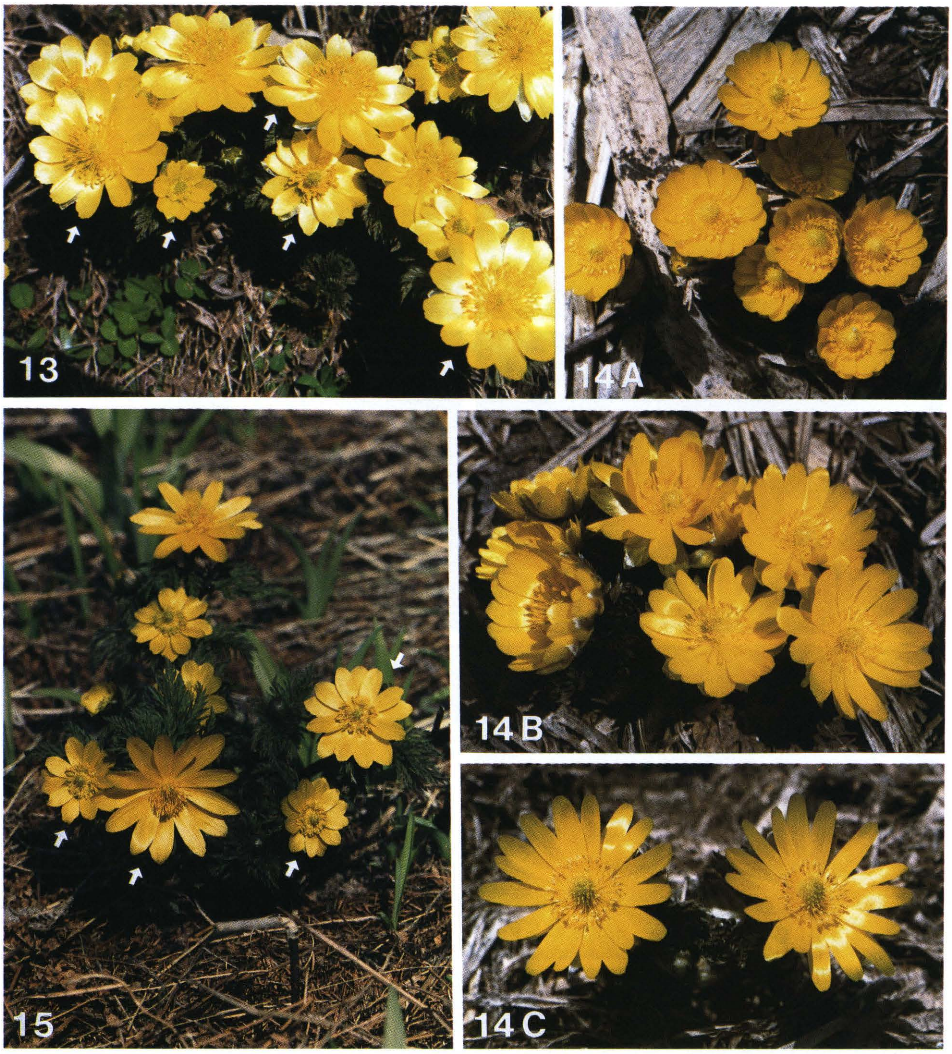
The small juvenile flowers just after perianth opening were inconspicuous and easily overlooked in the field. Therefore, except for the first stages of sepals from these juvenile flowers, the L/W values of sepals were rather constant in most populations. In other words, the sepals varied in shape as they developed, but they did not give the impression that they became "slender" when the flowers were fully developed. In two tetraploid populations (TS4973 and KD42280), however, the sepals did become slenderer as the flowers developed.

This is the first report showing the number of achenes per aggregate fruit in diploid and tetraploid plants. The results illustrated that there was distinct correlation between the number of achenes per aggregate fruit and the euploid change of chromosome numbers (Fig. 5). In triploids the number of pistils per gynoecium was closer to those of tetraploids (Table 2) than to the diploids.

The first report comparing the size of diploid and tetraploid aggregate fruits was made by Nishikawa and Ito (1978). They published a photograph of them, but did not remark on their size and the shape. Later, they published (Nishikawa and Ito 1985) the photographs of aggregate fruits obtained from the cultivars of *Adonis*, including diploid, triploid, tetraploid and pentaploid ones, and from wild diploid and tetraploid *Adonis*, mentioning that some diploids had smaller and globose aggregate fruits than the others. In an earlier paper Suda and Herai (1991) also reported that diploids and tetraploids were clearly distinguished by



Figs. 11–12. Photographs showing the variation of flower appearance during the floral development. 11A–D (CN32673: 宮古市近内) were photographed on Feb. 19, Feb. 26, Feb. 28 and March 8, 1997, respectively. 12A–D (NT4273 川井村小国) were photographed on Feb. 28 (A), March 4 (B) and March 8 (C and D), 1977. The flowers from population CN32673 varied much in appearance, while those from population NT4273 varied slightly during floral development. Both were tetraploids that had been cultivated in the experimental greenhouse for more than four years. A bar is 30 mm.



Figs. 13–15. Photographs showing the variation of flower appearance during floral development. 13: Photographed on April 6, 1987 at population AU42384 (tetraploid). Flowers at different developmental stages are found to have varied only slightly in their appearance (arrows). 14A–C: Photographed on April 20, 1993 at population TS4973 (tetraploid). Plants at different developmental stages showed various floral appearances. 15: Photographed on April 28, 1988 at population SS151577 (diploid). Flowers at different stages have various floral appearances in a single individual (arrows).

their size of aggregate fruits. The present study confirms that diploids and tetraploids are clearly distinguished by their size and/or by their shape of aggregate fruits (Figs. 7, 8).

The fact that the frequency of sterile achenes per aggregate fruit was higher in diploid populations (10–52%) than in tetraploid ones (2–30%) is not considered to be correlated with the euploid change of chromosome numbers. It may, however, be related to the difference of pollinators and the frequency of their visits during the flowering period (Suda unpublished).

No report of seed morphology has been

made previously. The difference of seed sizes between diploids and tetraploids was obscure (Fig. 9), as in the case of pollen grain sizes (Sohma and Suda 1992). Though the mean values of seed size in most tetraploids (4.0–4.9 mm) were usually larger than those of diploids (3.1–4.3 mm), tetraploids (FH42384) with smaller seeds (3.6–4.1 mm) were also found. Therefore, it can be inferred that seed size may not be a critical character to distinguish ploidy levels in the species.

The pattern and color of seed coats was clearly different between diploids and tetraploids in this species. It is one of the most useful distinguishing characters separating mature diploid and tetraploid plants in Japanese *Adonis* (Fig. 10).

I wish to express my sincere thanks to Prof. Dr. Walter H. Lewis, Department of Biology, Washington University in St. Louis, Missouri, for critically reading the manuscript and for his valuable suggestions during the preparation of this paper for publication. I am also indebted to Mr. Yoshinori Takahashi, Faculty of Education, Iwate University, Morioka, for his valuable assistance in preparing the figures.

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須田 裕: **邦産フクジュソウ属植物の分化（V）花の形質，分離複果，および種子**

野外でフクジュソウ個体群を観察すると，開花してから最盛期を経て花弁や萼片が落ちる全開花期間中に，ある個体群では花弁が長く細く伸びるので花の形状は大きく変わった印象を与えることがある．これとは反対に，時間の経過とともに花自身は大きくなるものの，花の形状はあまり変わらない個体群もある．これらの事実を確証するために，花弁と萼片は，花の発達につれてどの様に形状を変えるのか，を分析した．さらには，2倍体，4倍体のフクジュソウの個体群間では，分離複果の大きさ，形態および1分離複果あたりの痩果の数はどの様に異なるか，種子の大きさや形態にはどんな違いがあるか，についても検討して以下の結果を得た．

花弁の形状は，開花後花の発達・成熟とともに *ellispticus* → *obovatus* → *obtrullatus* の順で，中間型を含め連続的に変化する． 2倍体では64－65 *obtrullatus* まで変化するのが普通だが，4倍体では46－47 *obovatus* までのことが多い．L/W値の変化に基づいて，2倍体と4倍体の個体群は3グループに分けられた．萼片の形状は，開花後花の発達・成熟とともに *trullatus* → *rhombicus* → *obtrullatus* の順で，中間型を含め連続的に変化する．しかし，全ての型が2倍体，4倍体の個体群に見られるとは限らない．L/W値は，開花直後の花を除けば多くの場合ほぼ一定である．4倍体は長球状形 prolate spheroidal，稍長球状形 subprolate あるいは長球形 prolateの分離複果で，長軸の長さは14.5－21.0 mm,

一方2倍体は，稍扁球形oblateまたは扁球形oblate spheroidalの分離複果で，長軸は8.0 − 11.0 mmである．両者は外形的にはっきり区別できる．分離複果あたりの痩果の全数は，2倍体で24−53粒，4倍体で55 − 99粒と両者の間に明らかな相違がある．3倍体では1雌蕊群あたりの雌蕊の全数は，4倍体のそれとほぼ同じである．分離複果あたりの不稔痩果の割合は，4倍体（2 − 30 %）よりも2倍体（10 − 52 %）が高い．種子の長径は，2倍体から4倍体へと増加する傾向がある．種皮表面の網目状の紋様は2倍体が4倍体より顕著である．種皮の色は2倍体が褐色，4倍体は褐色がかった黒色である．

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